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Publication date:
2008

Document Version
Publisher's PDF, also known as Version of record

Special Session 9: From low to non-invasive site assessment and characterization: Model Driven Soil Probing

USING TREE CORE SAMPLES TO MONITOR NATURAL ATTENUATION AND PLUME DISTRIBUTION

Stefan Trapp[1], Charlotte N. Legind[1,5], Morten Larsen[1], Antonio Franco[1], Joel Burken[2], Jirina Machackova[3], Arno Rein[4], Philipp Mayer[5] and Ulrich Gosewinkel Karlson[5]

[1]Department of Environmental Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark, stt@env.dtu.dk

[2]Department of Civil, Architectural & Environmental Engineering, Missouri University of Science & Technology, Rolla, Missouri 65409, USA

[3]Earth Tech CZ Ltd, Trojská 92, 17100 Praha 7, Czech Republic

[4]Dep. Groundwater Remediation, Helmholtz Centre for Environmental Research - UFZ, 04318 Leipzig, Germany

[5]National Environmental Res. Institute, University of Aarhus, Frederiksborgvej 399, 4000 Roskilde, Denmark

The potential of using tree core samples to detect and monitor natural attenuation of perchloroethene (PCE) in groundwater was investigated at a PCE-contaminated site (Larsen et al. 2008). In the area of the known plume with PCE concentrations between 0.004 and >40 mg/L, cores were collected from tree trunks at a height of about 1 m above ground surface. Tree sampling of the site was completed in under six hours.

Chlorinated ethenes were analyzed by headspace GC/MS. PCE (0.001 to 7 mg/kg) and natural attenuation products, TCE (<0.001 to 0.4 mg/kg) and c-DCE (<0.001 to 0.46 mg/kg), were detected in tree cores. 1,1-dichloroethene and vinyl chloride were not detected, corresponding to very low concentrations in the groundwater.

The contaminant plume was mapped from the concentrations measured in trees, which delineated a probable hot spot area that had been undetected in decades of traditional groundwater monitoring. Natural attenuation products in tree cores increased with distance from the known source area. Concentrations of PCE and reductive dechlorination products in tree cores were correlated with the corresponding groundwater concentrations.

Within a range of limitations, tree-core sampling provides a rapid, reliable and inexpensive method to investigate the extent of shallow contamination by chlorinated ethenes in soil and groundwater (Larsen et al. 2008).

The research will be continued in the new EU project ModelPROBE, which targets non-invasive source determination of remediated sites. Within this project, we will use a combination of literature study, lab work and modeling (Trapp 2007) to seek for new indicator chemicals. We will develop better analytical methods for the analysis of nonpolar organic compounds in wood and other matrices using automated solid-phase microextraction (SPME) (Legind et al. 2007). We will also test the hypothesis that trees can be used to determine the movement of a subsurface plume in time. The new approaches will be tested at field sites in Italy, Spain, Czech Republic, Germany and Norway.

References

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